WHAT IS CLAIMED IS:

1. A method for controlling the dissociation of water into hydrogen and oxygen, comprising:

contacting a quantity of aqueous liquid with a quantity of dissociation initiating material in a reaction vessel;

monitoring the temperature, or pressure, or both, in the reaction vessel;

monitoring the surface area of dissociation initiating material in contact with the aqueous liquid; and

controlling the surface area of dissociation initiating material in contact with the aqueous liquid in response to the temperature, or pressure, or both, or in response to changes therein, in the reaction vessel.

2. The method of claim 1, wherein the monitoring of the surface area of dissociation initiating material in contact with the aqueous liquid comprises monitoring the level of aqueous liquid in the reaction vessel.

3. The method of claim 2, wherein controlling the surface area of dissociation initiating material in contact with the aqueous liquid comprises adjusting the level of the aqueous liquid in the reaction vessel.

4. The method of claim 3, wherein contacting the quantity of aqueous liquid with the quantity of dissociation initiating material comprises introducing the aqueous liquid into the

reaction vessel, and wherein adjusting the level of the aqueous liquid in the reaction vessel comprises varying the rate of introduction of the aqueous liquid into the reaction vessel.

5. The method of claim 3, wherein adjusting the level of the aqueous liquid in the reaction vessel comprises forcing aqueous liquid out of the reaction vessel in response to an increase in the pressure in the reactor.

6. The method of claim 5, wherein the aqueous liquid is forced out of the reaction vessel by a pressure differential between the reaction vessel and another vessel in fluid communication with the reaction vessel.

7. The method of claim 5, wherein the aqueous liquid is forced out of the reaction vessel by a pump.

8. The method of claim 1, wherein the aqueous liquid comprises an aqueous solution of alkali metal hydroxide.

9. The method of claim 8, wherein the alkali metal hydroxide is sodium hydroxide.

10. The method of claim 9, wherein the aqueous solution contains sodium hydroxide in a concentration ranging from about 4 M to about 10 M.

11. The method of claim 1, wherein the dissociation initiating material is a metal or metal compound selected from the group consisting of aluminum, alloys of sodium and aluminum, iron, zinc, sodium, and alkali and alkaline earth metal hydrides.

12. The method of claim 11, wherein the dissociation initiating material is aluminum.

13. The method of claim 1, wherein the aqueous liquid is an aqueous solution of sodium hydroxide and the dissociation initiating material is aluminum.

14. An apparatus for the controlled production of hydrogen by dissociation of water, comprising:

a reaction vessel having an inlet and an outlet, and adapted to contain a dissociation initiating material;

a solution reservoir in fluid communication with the reaction vessel and comprising a moveable barrier dividing the reservoir into a first compartment and a second compartment;

at least one pressure sensor, or at least one temperature sensor, or both disposed in the reaction vessel;

at least one liquid level sensor disposed in the reaction vessel;

at least one controllable valve disposed between the reaction vessel and the first compartment of the solution reservoir;

at least one controllable valve disposed between the second compartment of the solution reservoir and a source of constant pressure.

15. The apparatus of claim 14, further comprising at least one temperature sensor disposed in the reaction vessel.

16. The apparatus of claim 14, further comprising at least one pressure sensor disposed in the reaction vessel.

17. The apparatus of claim 14, further comprising a hydrogen storage vessel in fluid communication with the reaction vessel.

18. The apparatus of claim 14, further comprising a source of aqueous liquid in fluid communication with the first compartment of the solution reservoir.